Upper Mississippi River Nine-Foot Channel Project,
Lock and Dam Complex Number 18
Spanning the Mississippi River between
Gladstone, Henderson County, Illinois
and
Des Moines County, Iowa

HAER No. IL-29

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Rocky Mountain Regional Office
National Park Service
U. S. Department of the Interior
P. O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

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Location: Located in the Upper Mississippi River, about 7 miles upstream from Burlington, Iowa, and 410.5 river miles upstream from the confluence of the Ohio and Mississippi rivers. The complex stretches across the river at a point where the bluffs are well back from the river banks. The bottom lands on both shores are flat and irregularly punctuated by sloughs, marshes, and reeks. The river is dotted with low islands of various sizes. The Oquawka State Wildlife Refuge occupies the low lands immediately adjacent to the complex on the Illinois shore. The esplanade interrupts a levee and functioned as part of the Henderson River Diversion which converted Turkey Island into an extension of the Illinois shore. The lock is just riverward of the esplanade with the movable section of the dam tying to the westernmost lock wall. The earthen embankment section of the dam extends from the movable section across Rag and Slim islands to the Yellow Spring Creek levee along the Iowa shore. Corps Drawing Numbers M-L 18 10/1, 10/2; HAER Photographs Numbers IL-29-1 through IL-29-18.

Dates of Construction: 1934-1937

Present Owner: U. S. Government
Rock Island District
Corps of Engineers

Present Use: River navigation/hydrology control

Significance: The U. S. Army Corps of Engineers Nine-Foot Channel Project (1927-1940) represents the culmination of a 100-year effort to improve the navigability of the Upper Mississippi River between the mouth of the Missouri River and Minneapolis, Minnesota. This specific project arose as a response to the farm crisis of the 1920s. Proponents of the New Deal adopted the project and gave speed to its construction as a means of providing public employment during the more general depression of the 1930s. By the 1940s, the completed project had converted over 650 miles of free-flowing river into a series of interconnected reservoirs which ensured enough water for fully loaded modern boats and

barges to navigate the system. This constituted a significant alteration of the natural environment of the Upper Mississippi River. However, the project also brought economic benefits to the communities along and around the river corridor and lead to new recreational opportunities for the entire region.

The Upper Mississippi River Nine-Foot Channel Project inaugurated a new development in slack-water navigation system dam practice in the United States: the adoption of a non-navigable dam containing both roller and Tainter gates. Prior to the Corps' 1930 decision to build non-navigable dams on the Upper Mississippi River, United States Army engineering practice had, nearly universally, been to construct navigable dams, permitting open-river navigation at higher river stages. By 1930, European engineers had been using roller gates in dams extensively for over 25 years. However, only ten such structures had been built in the United States, and these were all located on reaches of rivers where ensuring navigability of any sort was not a design concern. It was not until 1925-1926 that civilian engineers pioneered the use, in the United States, of roller gates in combination with other types of gates. Most of the Corps' Upper Mississippi River project dam designs expanded upon this development, incorporating both roller and Tainter gates. The Corps' shift from navigable to non-navigable dams demonstrate the influence of shipping techniques on navigable waterway improvement technology. It also exemplifies the cautious nature of American Army engineers response to changes in shipping. The Corps' choice of this particular type of non-navigable movable dam illustrates the influence of the hydraulic characteristics of individual rivers on the selection of waterway improvement technologies. It also evidences the manner in which critical engineering design developments are disseminated and become accepted.

Ironically, the Upper Mississippi River Nine-Foot Channel Project also resulted in the obsolescence, by the project's end, of combination roller and Tainter gate dams. Technological advances resulting from the research and development incidental to the design and construction of the 26 lock and dam systems in this

project enabled U. S. Army Corps of Engineers to develop both submersible and non-submersible Tainter gates which nearly matched the capabilities of the roller gates. Once these less expensive and easier operated and maintained gates had been developed, American engineers ceased designing or constructing combination roller and Tainter gate dams. The Corps' creation of a new dam type and its subsequent obsolescence during the course of a single project dramatically illustrates both the evolutionary nature of American engineering in general and the Nine-Foot Channel Project in particular (Text, pages 11 and 49-50. See HAER No. IA-23 for complete history, footnotes and bibliography).

Historian: Mary Yeater Rathbun

August 1988

PART I. HISTORICAL INFORMATION

A. Physical History:

1. Dates of Erection: 1934-1937

2. Architect/Engineer: U. S. Corps of Engineers, Rock Island District

3. Original and Subsequent Owners: U. S. Government--Rock Island District, Army Corps of Engineers

4. Builders, Contractors, Suppliers:

General Contractor--Lock Construction: Maxon Construction Company, Dayton, Ohio

Subcontractors:

R. C. Mahon Company, Detroit, Michigan	Fabrication, erection, and placement of all structural steel: miter gates, tainter valves, castings, operating machinery, handrailings, floor gratings, etc.
Carl A. Nelson, Burlington, Iowa	Built central control station Reinforcing steel
Duke and Lewis, Burlington, Iowa	Concrete for central control station
Clifford Eads, Burlington, Iowa	Plumbing and heating in central control station
L. A. Pohren Electric Company, Burlington, Iowa	Electrical work in central control station
Frank Reid, bricklayer, Burlington, Iowa	Partitions and plaster in central control station
Ellis Lumber Company, Burlington, Iowa	Tile and terrazzo floors in central control station
Kruchbaum and Dewern, Burlington, Iowa	Sheet metal for central control station
C. D. Barngrover, Burlington, Iowa	Glazing and caulking central control station
E. A. Carlson	Painting central control station
Tri-State Dredging Company, Keokuk, Iowa	Cofferdam fill and removal
Wapello Construction Company, Wapello, Iowa	Cofferdam fill

General Contractor--Dam Construction: S. A. Healy Company, Chicago, Illinois

Subcontractors:

Keg Dredging Company.....	Dike fill, storage yard fill, removal and disposal of top soil, filling cofferdam cells, removal of dike fill from auxiliary lock, removal of cofferdam fill
Tri-State Dredging Company..... Keokuk, Iowa	Filling cofferdam cells
Wapello Construction Company..... Wapello, Iowa	Cofferdam fill
Burlington Tent and Awning Co.	Placing roofs on pier houses
McKenzie and Home, Inc.....	Placing rip rap on dike, placing crushed rock on dike
American Bridge Company.....	Fabrication, erection, and placement of structural steel: tainter gates, roller gates, operating machinery, service bridge, heaters for gates
Beckman Painting Company.....	Painting Tainter and roller gates, service bridge, operating machinery, bulkheads, and pickup booms

General Contractor--Power, Control, and Lighting System Construction: Kelso-Burnett Electric Company, Chicago, Illinois

General Contractor--Henderson River Diversion: Edward M. Rocho, Freeport, Illinois

Subcontractors:

Keg Dredging Company.....	Excavation Henderson River Channel
Birch Construction Company.....	Placing dike embankment on Henderson River

General Contractor--Roadway: C. R. Gates, Ottumwa, Iowa

General Contractor--Esplanade: Layton and Plumb, Muscatine, Iowa

5. Original Plans and Construction:

U. S. Army Corps of Engineers, Rock Island District, plans for lock submitted by associate engineer E. E. Abbott. By the time he submitted the plans for the dam, Abbott had been promoted to senior engineer.

6. Alterations and Additions:

Item	Year
Replacement-Tainter gate operating machinery	1937
Construction-500-foot cell foundation concrete extension to upstream end of river wall of lock	1940-1941
Land wall and lock gate handrails lowered by one rail and new handrail made from salvaged materials installed on both edges of each lock wall and on upstream side of walkways on top of lock gates	ca. 1945
Construction-handrail on upstream side of dam service bridge	ca. 1945
Construction-upstream guidewall extension and mooring facilities	1951
Lock dewatered for repairs, while dewatered pressure from bellow blew out floor of lock, floor not replaced, patched holes and regrouted	1953
Addition lip on spillway	1969-1970
Construction-frame air-lock vestibule at upstream end door of central control station	ca. 1970
Addition-boat launches on lock walls	ca. 1970
Replacement-haulage units	ca. 1971 and 1973
Construction-metal and glass shelters around land wall control cabinets and at end of the guidewall of lock	ca. 1972

Concrete cracked and spaulled during earthquake	1973
Removal-Lockmaster/Assistant Lockmaster residences from esplanade	ca. 1975
Removal-standby generator for machinery room of central control station	ca. 1975
Construction-emergency generator building	ca. 1975
Replacement--wooden plank hatches on dam service bridge with aluminum ones	ca. 1979
Installation-traveling mooring kevels extending length of guidewalls of lock	1980
Construction-new workshop building	1980-81
Construction-concrete, metal, and fiberglass covers over machine pits on main lock	1983
Replacement-crane on dam	1983-1984
Land wall of lock undermined in spring flood, holes filled with sand	1984
Replacement-light posts and light fixtures around lock	1984
Replacement-exterior wall covering of central control station and frame air-lock with brick one incorporated into main building	1985

B. Historical Context:

The special board of engineers which initially designed the Nine-Foot Channel Project between 1929 and 1931 saw the construction of Lock and Dam Complex 18 as a high priority and placed it in the third group of projects to be constructed. The Corps relocated the complex in 1932. After developing a plan to divert Henderson Rover so that it entered the Upper Mississippi immediately below the lock and dam complex, the Rock Island District redesigned the dam in 1936. The 2,120-foot-long curve earth and sand-filled submersible dike protected by concrete slushed riprap traversing Rag Island followed by a 3,470-foot-long non-submersible dike crossing Slim Island to the Iowa shore was a radical departure from the original plan for the stationary section of the dam. The original plan

provided for a 1,955-foot long ogee spillway on the axis of the dam adjoining a 4,500-foot-long non-submersible section extending upstream to the Iowa shore.

The Rock Island District designed Dams 18 and 11 concurrently. Most specific items of engineering significance at complex 18 relate to the dam. Dams 11 and 18 were the first in the Rock Island District to employ 2b Tainter gates, that is, submersible, elliptical Tainter gates. Dams 11 and 18 were also the first two dams in the District to utilize submersible roller gates. As the two dams were being constructed, improvements were made in the operating machinery for the gates. These changes were not, however, sufficient in regard to the Tainter gates. In January 1937, the Corps decided to change to heavier gears with increased diametrical pitch in the Tainter gate operating machinery. These were installed under a separate contract after the dams were completed.

As completed, complex 18 consists of a dam system composed of 13 2b-type Tainter gates, three submersible roller gates, and a submersible earth and sand-filled dike, a non-overflow earth and sand-filled dike, and two transition dikes. Lock dimensions are the standard 110 feet by 600 feet, with additional footings for an auxiliary lock of standard dimensions. Lock lift is 10.5 feet, with additional footings for an auxiliary lock of standard dimensions. Lock lift is 10.5 feet. Normal upper pool elevation is 529.0; this is about 13 feet above the tail waters of the dam at low water. When both pools are at their normal depth, the difference is reduced to 9.8 feet or less.

The lock and dam elements of the complex took about three and a half years to complete, at a cost of $5,886,000. During the peak of construction, in September 1934, 960 men were employed as laborers, with 74 men acting as supervisors. Average employment was 478 laborers and 44 supervisors. The complex was placed in operation as a unit of the Upper Mississippi River navigation system on September 8, 1937. It was the fourth of the 1931-1940 Upper Mississippi River Nine-Foot Channel Project complexes in the Rock Island District to go on line.

PART II. TECHNOLOGICAL INFORMATION - LOCK

A. General Statement:

1. Design Character: Standardized Ohio-Mississippi Lock Design. Drawing Number M-L 18 20/1.

2. Condition of Fabric: Good.

B. Description of General Layout and Principal Elements:

1. Overall dimensions: Main lock chamber - 110 feet wide by 600 feet long by 40 feet high: adjoining incomplete auxiliary lock chamber 110 feet wide by 40 feet high. Lift - 10.5 feet. Drawing Number M-L 18 20/1.

2. Foundations: 30-foot-round timber pile with 25 to 30 feet sheet piling cutoff walls enclosing outside limit. Drawing Number M-L 18 20/2.

3. Walls: Reinforced monolithic concrete with steel rub bars on their chamberward faces upstream and downstream from the lock gates. Land wall adjoins levee incorporating Turkey Island as part of Illinois shore. Intermediate wall is riverward wall of main lock and landward wall of incomplete auxiliary lock. River wall of auxiliary lock ties to dam on west. Drawing Numbers M-L 18 20/4, 20/6, 20/9, 20/19, 20/20, 20/28, 40/1.

4. Structural System: See above.

5. Bullnoses: Concrete configurations at each end of intermediate wall. Drawing number M-L 18 20/19.

6. Upper and Lower Guidewalls: Extended monolithic reinforced concrete walls extending the landwall out of the lock chamber at either end to assist guiding of barge traffic into the lock. Drawing Number M-L 18 20/11.

7. Riverwall Extension: 500-foot long cell foundation, concrete extension to upstream end of riverwall. Added 1940. To assist in counteracting outdraft which made navigation into and out of the upstream end of the lock difficult. Drawing Number M-L 18 10/39A.

8. Guidewall Extension: Extension to upstream end of upstream guidewall. Added in 1951 to assist in counteracting outdraft which made navigation into and out of the upstream end of the lock difficult.

9. Stage Recorder: Small concrete housing located at the end of the downstream guidewall. Equipment housed for the recording of river stages.

C. Mechanical Equipment:

1. Tainter Valves: Four cable drive lock valves of steel construction with electric motorized assembly. Valves are located in wells in lock

walls. They are operated by switches in weather-proof control cabinets on lock walls, with a cabinet beside each gate recess. Control cabinets on landwall surrounded by metal and glass shelters since mid-1970s. Drawing Numbers M-L 18 25/11, 28/1, 20/12.

2. Gates: Two pairs of miter gates on main lock and one pair on upstream end of incomplete auxiliary lock. All three pairs are balanced on stainless steel pintels. Those in main lock are operated by arms, gears, and electric motor assemblies. Motor assemblies originally housed in machinery pits in lock walls adjacent to each leaf. Machinery pits for main lock machinery covered by raised concrete, metal and fiberglass enclosures in 1983. The gates are operated by switches in control cabinets. Bumper lines of chamber face of gates also of stainless steel. All other associated metal parts are of steel, stainless steel, or steel/nickel alloy. Drawing Numbers M-L 18 21/1, 21/17, 22/13.

3. Lighting: Various freestanding single and double head lighting standards, installed in 1984.

4. Plumbing: Lock is watered by the Tainter valves (see previous page) serving a system of cast-in-place tunnels that enable the water level to be controlled on the interior of the lock.

5. Haulage Unit: Motorized winch assembly to assist towing of barges through lockage. Replacement units were installed in the mid-1970s.

6. Traveling Mooring Kevels: Two large cleats on rails which extends the length of both the upstream and downstream guidewalls. Installed in 1980, the kevels are used to assist towing of barges through lockage.

D. Other Elements:

1. Auxiliary Lock: Fixed miter gate without machinery and partial walls are located riverward of the main lock. It is equipped with wells for machinery placement, but was never completed or put into service. Drawing Numbers M-L 18 20/1, 20/5.

2. Boat Launches: Built ca. 1970, the launches are single-armed derricks of metal construction,used to load and unload materials as well as to launch life boats.

PART III. TECHNOLOGICAL INFORMATION--MOVABLE SECTION OF DAM

A. General Statement:

1. Design Character: Combination roller/tainter low dam system design. Drawing Number M-L 18 40/1.

2. Architectural Character: 2a roller gate piers. Drawing Number M-L 18 40/2

3. Condition of Fabric: Excellent.

B. Description of Exterior

1. Overall Dimensions: 1,545 feet in length. Drawing Number M-L 18 40/1.

2. Foundation: 30-foot-round timber pile with 25 to 30 foot sheet piling cutoff walls enclosing outside limit.

3. Pier House Walls: Monolithic reinforced concrete. Drawing Numbers M-L 18 41/1 and 41/2.

4. Structural System: Monolithic concrete/structural steel.

5. Fenders: Concrete fenders located at the base of each pier.

6. Openings:

a. In Overall Structures: 17 water-channels and 2 archways; clustered in groups by sizes, east to west--5 water-channels ca. 60 feet wide; 3 water-channels ca. 100 feet wide; 9 water-channels ca. 60 feet wide; 2 archways ca. 60 feet wide. Drawing Number M-L 18 40/1.

b. In Pier Houses: 1 doorway and 11 three-pane windows for each of four pier houses. Drawing Number M-L 18 40/2.

(1) Doorways and doors: 4

(2) Windows: 44

c. In Access Tower: 2 doorways and doors. Drawing Number M-L 18 40/4.

7. Roofs:

a. Shape, covering: Pier houses have flat roofs covered in membrane/tar composition. Drawing Number M-L 18 41/3.

b. Towers, abutments, piers: 2 abutments; lockwall abutments includes access tower; 18 piers (12 tainter gate piers, 2 2a-style roller gate piers, 2 2a-style transition piers or combination tainter and roller gate piers, and 2 service bridge extension piers); 4 2a-style piers have pier house towers. Drawing Numbers M-L 18 40/1, 40/4, 40/17, 40/3, 40/2, 40/10, 40/11, 40/12, 40/13, 40/25.

8. Service Bridge:

a. Shape: Arched spans in a segmental series.

b. Materials: Structural steel. Drawing Number M-L 18 53/1.

C. Description of General Layout and Principal Elements:

1. Access Plan: Simple stairway in the access tower which itself is part of the abutment resting on the riverwall of the auxiliary lock. This stairway leads to service bridge deck where walkway/rail track extends full length of dam. Access to all four pier houses directly off deck. Access to storage yard below easternmost 200 feet of dam by simple exposed stairway at the eastern end of service bridge. Drawing Numbers M-L 18 40/1, 40/4, 53/1, 53/9, 53/10.

2. Stairways: In access tower-reinforced concrete with pipe railing; at end of service bridge extension--open metal with pipe railing. Drawing Numbers M-L 18 40/4, 53/1.

3. Flooring: In pier houses and access tower--reinforced concrete; on service bridge deck--wooden plank. Drawing Numbers M-L 18 40/4, 53/10.

4. Wall and Ceiling Finish: Reinforced concrete. Drawing Numbers M-L 18 40/4, 40/5.

5. Hardware: Brass.

D. Mechanical Equipment:

1. Movable Gates: Fourteen 60-foot-wide by 20 feet high, 2b-type Tainter gates operated by line shafts and motors housed in installations above

each gate--3,100 foot wide by 20 feet high, 8-foot submersible roller gates operated on tooth track by chain-driven hoist machinery located in pier house adjacent to each gate. Drawing Numbers M-L 18 48/1A, 47/1, 55/1A, 54/1.

2. Movable Crane: 30-ton vertical lift electric crane with 70-foot boom (replaced in 1983-84) used for moving parts and equipment. Sits on original (ca. 1937) crane trolley, which also supports additional bridge crAne used for lifting emergency bulkheads, etc. Trolley rides on 15-gauge track system running entire length of service bridge deck. Drawing Numbers M-L 18 53/11, 53/10, 58/3.

3. Lighting: Fixtures as of times of installation - 1936-37. Rewiring may have taken place over the years--extent is unknown. Drawing Number M-L 18 56/1.

E. Other Elements:

1. Earth Dike: Three dikes in sequential series--2,200-foot-long curved earth and sand-filled dike protected by riprap slushed concrete traversing Rag Island followed by 10 to 1 slope earth and sand-filled transition dike leading to a 3.70-foot-long non-submersible earth and sand-filled curved dike crossing Slim Island to the Iowa shore.

2. Emergency Bulkheads: Temporary block units of riveted structural steel girder construction placed in gate openings in periods of emergency or repair. Drawing Numbers M-L 18 58/1, 58/2.

3. Emergency Bulkhead Car/Tracks: Located in storage yard, the flat cars designed to store and access bulkheads. Drawing Number M-L 18 53/12, 40/24.

3. Storage Yard: 195-foot-long area extending from east abutment under service bridge extension, i.e., under last two archways in dam. The yard contains replacement parts for gates, bulkheads on track cars and related repair items. Drawing Number M-L 18 40/24.

PART IV: TECHNOLOGICAL INFORMATION-ESPLANADE AREA

A. Description of Esplanade--General Layout:

1. Design Character: Standardized park/service area and access road component. The main esplanade area was originally designed to accommodate the Central Control Station, Lockmaster and Assistant Lockmaster Residences, parking, and other service-related functions. The approximately 6,530-foot-long roadway is 20 feet wide. Major site

alterations have occurred since that time and are noted in the following items.

2. Architectural Character: 1b Central Control Station. Drawing Number M-L 18 70/1.

3. Historic Landscape Design: Based on standardized designs--see drawings for Lockmaster's residences. Drawing Number M-L 18 38/1.

B. Condition of Site and Structures: Altered

1. Central Control Station - Exterior: Standardized 1b construction. Major alteration in 1985 rehabilitation project placed insulation and face brick over original concrete finish. For original, see Drawing Number M-L 18 70/1. Drawings for rehabilitation available from Rock Island District Office.

   a. First Floor: Contains machinery room where central control panel is located, bathroom, main office, and basement stairway access. Standby generator which dominated machinery room removed in mid-1970s. Drawing Number M-L 18 70/2.

   b. Basement: Contains storage and equipment rooms. All interior finishes altered from original construction. Drawing Number M-L 18 70/2.

2. Lockmaster's/Assistant Lockmaster's Residences (standardized, Colonial Revival with side porch): The structures has been moved off site to locations in Dubuque, Iowa. Most related structures have been demolished. Two-car garage which served the two houses is still in place.

3. Outbuildings: Various sheds and service buildings have been erected from time to time as demands required--none have particular significance or contribute to the site. A metal emergency generator building was constructed just upstream from the Central Control Station in the mid-1970s. It is a standardized element. A new garage structure of brick and steel was erected on the old site of the Lock Master's residence ca. 1980. This element is also standardized.

PART V: SOURCES OF INFORMATION

A. Original Architectural/Engineering Drawings: Mississippi River Lock and Dam 18, lock operations folio; Mississippi River, Lock and Dam 18, dam operations folio, Rock Island District Office-Construction Drawings--Mississippi River Locks and Dams 1937-1986, (passim), Rock Island District Library, Clock Tower Building Annex, Rock Island, Illinois.

B. Early Views: Over 1,600 high quality 8x10 black and white construction photographs: Lock and Dam Number 18-Photo Book groups 1380 (5 vols.), 1890, 1895, 1870, Rock Island Arsenal, Rock Island, Illinois.

C. Interviews: Present and past personnel--Lock and Dam Number 18, near Oqawka, Illinois.

D. Bibliography:

1. Primary and unpublished sources: National Archives Record Group 77, Entry 81, Chicago National Archives and Records Center; National Archives Record Group 77, Entries 111 and 112, Washington National Records Center, Suitland, Maryland; Chief of Engineers Annual Reports, 1927-1987; see also bibliography in HAER No. IA-23 narrative history.

2. Secondary and published sources: See bibliography in HAER No. IA-23 narrative history.

E. Likely Sources Not Yet Investigated: National Archives Record Group 77, Entry 107 (132 linear feet), Washington National Records Center, Suitland, Maryland; National Archives Record Group 77, Entry 1656, exact repository unknown; and National Archives Record Group 77, Entries 608, 609, and 610 (collective total 5 linear feet), National Archives, Washington, DC.

F. Supplemental Material: 83 film canisters of 1931-1939 silent movies of the construction process taken by the Corps of Engineers, Rock Island District Office, Rock Island Arsenal, Rock Island, Illinois.

G. Notes: The notes for this outline are contained in the notes section of HAER No. IA-23 narrative history.